TOP SECRET

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Series A.

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29 July 1954

Assistant for Development Planning
Office, Deputy Chief of Staff, Development
Headquarters United States Air Force
Washington 25, D. C.

Attention: Lieutenant Colonel Beryl L. Boatman

Reference: AFDAP-R, dtd 25 May 1954

Dear Colonel Boatman:

The pre-D-day section of the Intelligence and Reconnaissance DPO has been reviewed by the persons suggested in the reference letter, as well as by other interested RAND personnel. Comments made by R. C. Raymond and A. L. Hiebert were contained in letter number L-10014, dated 17 June 1954. The following paragraphs contain additional comments made by the several other Rand personnel who read the draft.

Near the bottom of page 8 of the draft, the deficiency in intelligence currently possessed as well as in collection methods is pointed out. A strong corollary point is that unless collection methods are rapidly improved, our intelligence position will steadily decline, since much of our present information is based on obsolescent (or obsolete) German data.

We agree with the argument on page 35 that our best combat vehicles should not be used for overflights, in order to avoid compromising secrecy. A stronger argument is that the use of first line combat aircraft could frighten the Russians into a full scale bombing attack against the U.S. One inconsistency seems to arise in the draft: at the top of p. 33, the use of the "very best engines, as they become available" is advocated. This seems inconsistent with concealing our technology from the Russians, since engines are a major index of our state of art.

The summary of performance characteristics of reconnaissance vehicle possibilities, on p. 36, appears to contain an erroneous radius for the B-52. Perhaps this is a typographical error.

The balloons described on page 42 should not necessarily be "naval launched" - in fact, as far as we know, the operation is now being planned for ground launching, providing this can be arranged with the "real estate dealers" involved. In either case, however, the coverage shown in Fig. 21 would not be affected.

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Discussion of the satellite beginning on page 47 is in general agreement with our opinions. Some aspects which seem to disagree, such as duration, are partly matters of opinion or intuition that can be decided finally only by actual operation of the vehicle.

There is some doubt (page 56) that a special high altitude airplane is obtainable by 1957. Furthermore, it isn't made clear why high altitude rather than high speed is desirable for a reconnaissance vehicle. Bombers, for example, are tending toward high speed as a method of reducing vulnerability.

We are favorably impressed with the content and organization of this section of the Intelligence and Reconnaissance DPO and will be happy to comment on subsequent sections at any time.

Sincerely,

J. E. Lipp
Missiles Division

CPB:JEL:sp

TOP SECRET

1 ST AIR DIVISION
(METEOROLOGICAL SURVEY)
STRATEGIC AIR COMMAND

FINAL REPORT
PROJECT 119 L

[redacted]

STRATEGIC AIR COMMAND

D-582

FINAL REPORT

PROJECT 119L

TITLE PAGE

1ST AIR DIVISION (METEOROLOGICAL SURVEY)

FINAL REPORT

PROJECT 119L

1. This is a document and will be handled in accordance with the provisions of AFR 205-1. It contains information affecting the National Defense of the United States and, accordingly, utmost security will be afforded and distribution and dissemination of its contents will be restricted on a "need to know" basis. The international implications of this operation are such that extraordinary efforts should be expended by all to protect the government even beyond the precise provisions of Air Force regulations. In this regard, it is strongly urged that all personnel acquainted with the project be again cautioned against inadvertent disclosure of information pertaining to the actual project, even though the operation has been terminated.

2. The information contained herein will not be released to foreign nationals.

3. Reproduction of this document in whole or part is prohibited, except with the permission of the office of origin.

J. P. FISHER
Brigadier General, USAF
Commander

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ADDENDUM

I. A cut-off date of 5 March 1956 was established for compilation of statistics on this operation. Subsequent to that date the following vehicles, which were originally entered in the basic report as "Successful Launches", have been recovered in the European area. No transmissions were received from these balloons. For any gross analysis of the statistics contained in this report the category for the following enumerated balloons should be changed from "Successful Launch" to "Failure" or "Stray" as indicated below:

A. Failures:

Flight Number	Line Number	Balloon Serial Number	Type
ADA 109	2114	648	66CT
ADA 116	2124	655	66CT
ADA 150	2109	676	66CT
ADA 151	2110	646	66CT
GIE 96	5097	704	66CT
EVA 71	1071	826	66CT

B. Strays:

EVA 88	4088	353	66CT
ADA 35	2035	19	66CT

INDEX

CHAPTER I

GENERAL SUMMARY

I. INTRODUCTION:

A. General: This is the Final Report of Project 119L conducted by Strategic Air Command through the 1st Air Division (Meteorological Survey). This report is intended to cover the primary mission for which Weapons System 119L was designed, plus related pre and post mission activities. In the event a more complete analysis of the project is contemplated, reference must be made to those documents listed in Chapter V plus data available to Air Force Cambridge Research Center, ARDC. Weapons System 119L is described in Tabs "A" and "B", Chapter III.

B. Mission: To obtain photographic and electronic reconnaissance of the Union of Soviet Socialist Republics and its satellites using Weapons System 119L.

C. Assignment of Mission: Weapons System 119L was developed by Air Force agencies and civilian institutions for the purpose of conducting pioneer reconnaissance by use of high altitude balloons. Headquarters USAF monitored this project during the initial planning and development stages by direct coordination with individual commands. It became apparent that a single command was required to further develop, coordinate and conduct the operation. The Strategic Air Command was assigned this responsibility in USAF letter, Subject: "Assignment of Additional Mission to Strategic Air Command", dated 21 March 1955.

D. Activation of 1st Air Division: To accomplish the mission, Strategic Air Command activated the 1st Air Division at Offutt Air Force Base in SAC General Order Number 26, dated 15 April 1955. The Mission of 1st Air Division was established in SAC Regulation Number 23-7, dated 15 June 1955.

E. Concept of Operations: The basic concept was to accomplish launches from Western Europe. Balloons were expected to transit the target area in seven to ten days and then be tracked and recovered within the Far East and Alaskan areas.

1. Initial Schedule of Actions: The most favorable period for launch was determined to be 1 November through 1 May during which period the prevailing winds were predicted to be West to East at all altitudes. This was therefore established as the period during which the operation would be conducted. Based on this period of favorable winds it was planned to conduct Zone of Interior Operational Suitability Testing and Training during the period May 1955 through September 1955. There would then remain sufficient time for the units involved to deploy to forward bases and prepare such bases prior to the implementation date, 1 November 1955.

2. Organization:

a. 1st Air Division was assigned operational control of the 456th Troop Carrier Wing (TAC), equipped with C-119 aircraft for recovery operations; 1110th Air Support Group (HEDCOM), the balloon launching organization; and the 6926th Radio Squadron (Mobile) (USAFSS), to perform the tracking function. Because of the peculiar nature of the mission, responsibility for operational control of the launch and recovery units was almost immediately expanded to include responsibility for training units and crews. This expansion of responsibility was accomplished by mutual agreement, between the Commander, 1st Air Division, and the Commanders of the parent commands. Also, because of the tremendous quantities of material involved which required shipment overseas to meet deadline dates, it became apparent that 1st Air Division should be given the responsibility of monitoring procurement, development, shipping, etc. Accordingly, these logistical responsibilities were also transferred by mutual consent of commanders concerned.

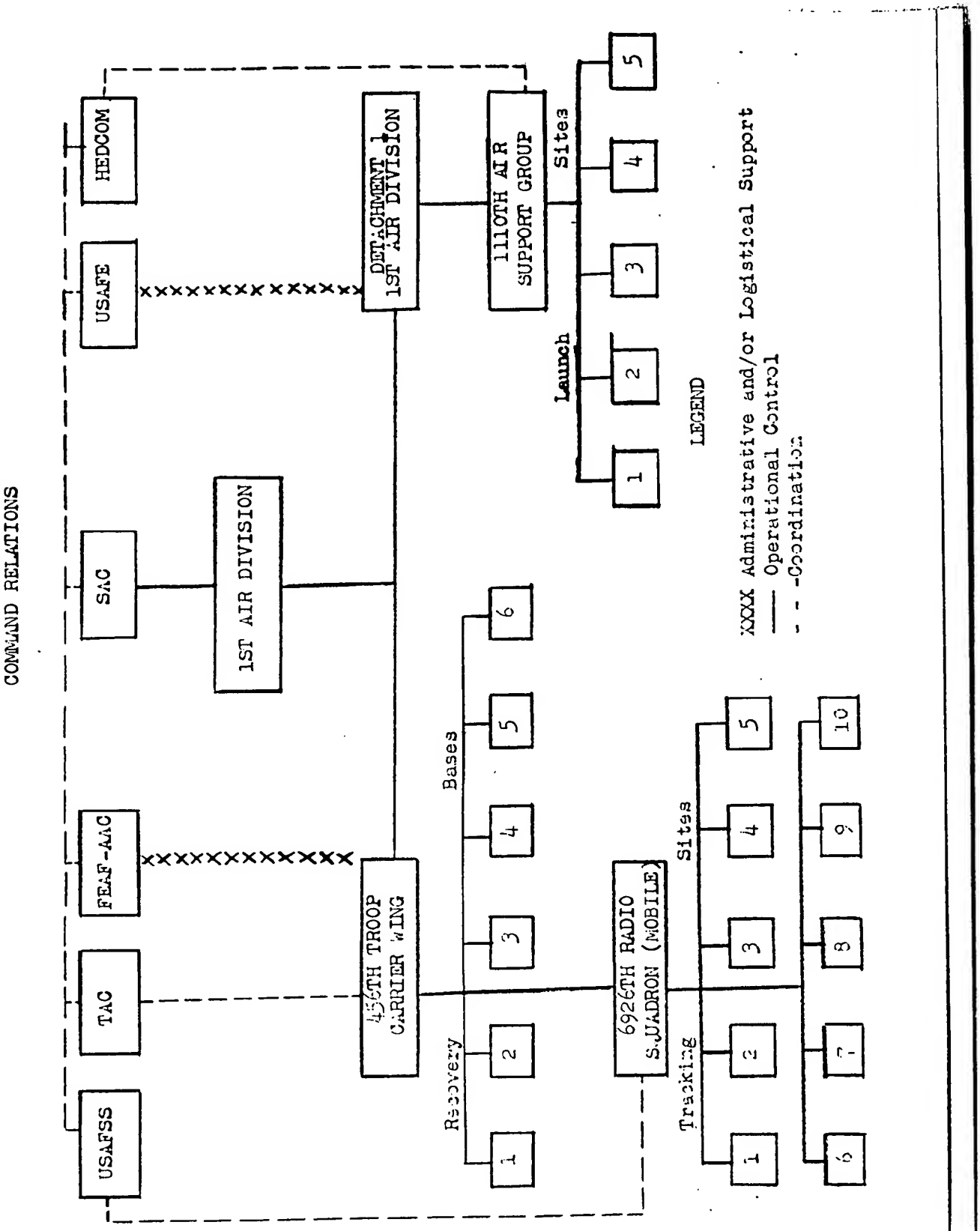
b. 1st Air Division established Detachment 1, 1st Air Division, as a forward command post for the purpose of coordinating launch, support and public information requirements and effecting necessary liaison with supporting agencies. This detachment was activated 9 June 1955. Its mission was later expanded to include the requirement to exercise operational control of all European area launches. Headquarters 1110th Air Support Group, directed the activities of the five launch detachments.

c. Headquarters 456th Troop Carrier Wing was established at and functioned as a forward command post for the purpose of coordinating tracking, recovery and public information requirements and effecting necessary liaison with supporting agencies in the Far East. The 456th Troop Carrier Wing exercised operational control over tracking and recovery activities.

d. A graphic presentation of command relationship is contained on the following page.

3. Selection of Operational Sites:

a. Prior to assignment of Project 119L to Strategic Air Command, it was considered that all balloons should be launched from . A further study of meteorological data indicated that more complete coverage could be obtained if sites were widely dispersed in Western Europe; besides, surface weather was expected to be unsuitable for launch activities a large part



of the time. In addition, the distance from the area of interest resulted in a day or so of balloon travel before the photographic mission could be started, an important factor when the criticality of balloon life expectancy is considered. Based on studies of trajectory and surface weather, general areas for the location of launch detachments were selected.

After selection of the general areas, USAF directed that specific locations be selected by CINCUSAFE. This permitted consideration of logistical feasibility, physical adequacy, and other pertinent information pertaining to the theater and known to USAFE Headquarters. Criteria for physical adequacy to support balloon operations were stated by 1st Air Division.

In June 1955, the Commander, 1st Air Division, and members of his staff visited each of the primary sites with a view toward inspecting the physical facilities available and stating specific requirement for site preparation.

b. The three squadrons of the 456th Troop Carrier Wing were divided into detachments comprised of eight C-119 aircraft each and placed at recovery sites believed to be compatible with the predicted upper air trajectories.

c. Location of tracking sites was predicated upon the forecasted flow of balloons into the recovery area and the requirement to obtain adequate "cuts" of lines of position (bearings) to establish fixes.

At termination of the project an additional site had been activated at Nome, Alaska, due to a requirement based on experience gained during actual operations, and Formosa was being surveyed to determine the feasibility of locating a site on that island.

4. Communications:

a. The 1st Air Division communications network was composed of commercially leased and allocated military teletype circuits. The network was parallel to command control channels; i.e., from the launch sites to the Launch Control Center
from the recovery base to the Recovery Control Center
and from Headquarters 1st Air Division to both the Launch and Recovery Control Centers.

5.

II. TRAINING PHASE:

The training phase for ZI units was originally scheduled for the period 10 May to 1 September 1955, leaving a month for deployment and a month for shakedown overseas. However, due to the fact that equipment non-availability resulted in very little activity during the month of July and the fact that equipment deficiencies dictated further testing prior to beginning operations, decision was made by Headquarters USAF that the operational date would be postponed 30 days (from 1 November to 1 December 1955).

This decision and other considerations made it possible to extend the training phase until mid-October.

A. Moby Dick Hi: Limited information was available concerning balloon operations, therefore 1st Air Division conducted Moby Dick Hi operations in The Zone of Interior during the period 10 May 1955 through 16 October 1955 for the purpose of testing operational suitability, developing procedures and tactics, resolving deficiencies, determining capabilities and accomplishing on-the-job training. Originally, only twenty-five balloon systems were to be

provided for this project; however, 1st Air Division estimated that a minimum of 150 would be needed if the testing and training were to be accomplished on an acceptable basis. A requirement for this number of systems was established, and later was slightly increased. The final report or this operation is contained in 1st Air Division TOP SECRET document entitled "Final Report of Operational Suitability Test Project 119L".

1. Training: With initial guidance from AFCRC and General Mills (balloon manufacturer), the training and suitability testing of the system was conducted in the Zone of Interior in accordance with 1st Air Division Operations Order 201-55.

a. Launch: During project Moby Dick Hi the 1110th Air Support Group launched 162 119L systems. These launchings provided the only opportunity for development of procedures and the accomplishment of initial and final training prior to actual operations.

b. Hydrogen Generation: It was anticipated that the hydrogen gas required for Moby Dick Hi would be produced by primary mission generators at Francis E. Warren AFB, Wyoming. Initially these generators proved incapable of providing the required quantities and quality of hydrogen. Major revisions in procedures and ad ptions of mechanical aids rendered the system serviceable.

c. Tracking: Moby Dick Hi balloons were tracked by USAFSS, FCC, and AACS. No training was accomplished by the 6926 Radio Squadron (Mobile) (primary mission tracking unit), since it was manned at overseas stations during and subsequent to the Moby Dick Hi operation. (See paragraph IIB below.)

d. Recovery: Recovery operations were conducted by the 456th Troop Carrier Wing operating from their home base at Charleston AFB, South Carolina. Air-to-air and air-to-surface recovery techniques were without precedent and the first SOP's for such were developed during the Moby Dick Hi operation. Air-to-air recovery action was successfully accomplished on twelve of the thirty-nine systems on which attempted recoveries were possible. As of completion of Moby Dick Hi, the air-to-water recovery tactic had not proven successful due to water station deficiencies.

2. Operational Suitability Test: During Moby Dick Hi, techniques of varying balloon initial floating altitudes were investigated and developed into SOP. Also it was found that ascent rates and hydrogen purity were less critical than previously believed. It was also determined that the basic equipment for primary mission operations was adequate with the following major exceptions:

a. The 128TT balloon was determined to be marginally serviceable. The unacceptably high failure rate of this balloon type (approximately 50%) which was experienced through the month of August, led to a decision that the contract for this type should be terminated at the mid-point and the 66CT balloon substituted for the remainder. Although not fully tested at the time, the 66CT was the only other balloon in the inventory capable of doing the job and had been developed expressly for this project. Because of its cylindrical design it was thought to be stronger structurally and less apt to fail under stresses of ascent. It had similar life expectancy, but flew at lower maximum altitudes (45,000 - 60,000 as compared to 75,000 - 85,000) than the 128TT. At the lower altitudes it picked up faster winds and, as a result, doubled the expected rate of arrival in the recovery area. A disadvantage was the possibility of increased vulnerability; however, ADC was unable to demonstrate that the increase would be greater than slight in attempting to locate and intercept the small number (15-20) of these balloons launched in the ZI. As a result of the decision to convert the contract from the large balloon to the smaller one, there were approximately 1,300 of the 128TT type and 1,500 of the 66CT type available for accomplishment of the primary mission.

b. Minor mechanical innovations and a major revamping of procedures were required to render the gas generation system serviceable.

c. The degree of success to be expected from air-to-air and air-to-water tactics remained in doubt.

d. Launch Device: The forklift launch vehicle was determined to be inadequate and unsafe due to size, weight, limited visibility and limited mobility. The forklift was replaced with the Fisher Launcher, which was a $2\frac{1}{2}$ ton 6X6 truck with a superimposed structure from which the gondola was suspended and released.

3. Vulnerability Test: During Moby Dick Hi, a test was conducted to determine the vulnerability of the 119L system. To accomplish this test Air Defense Command instructed subordinate units to attempt detection and termination of Moby Dick Hi balloons to maximum degree short of interference with the ADC primary mission. During the test ADC was advised of launch times, expected trajectories, and balloon fixes as they became available. Results indicated a limited capability to track balloons using either radar or ground observers. It was demonstrated that balloons at altitudes attainable by fighter aircraft could be destroyed by fighter action if located. It was concluded that the degree of vulnerability to be expected would be directly proportional to enemy capability to

locate and track the balloons. Although inconclusive insofar as Russian radars were concerned, test results did not indicate radar tracking capability to be good, (See Tab I, Chapter III), and it was estimated that the balloon system was not unacceptably vulnerable.

B. Moby Dick Far East: The Moby Dick Far East program (1st Air Division Operations Order 202-55) was established primarily to provide training for, and to obtain factual information on the capabilities and limitations of, the 6926th Radio Squadron (Mobile). This was done by simulating primary mission operations in the Far East and Alaska areas during the period 7 September 1955 to 27 December 1955. A total of 211 Moby Dick balloons were launched by two launch teams from sites in . All phases of the tracking functions were exercised during this period. After 23 November 1955 the balloons carried VHF transceivers, which made it possible for recovery crews to fly realistic training missions actually intercepting and homing on balloon signals. Additional benefits derived from this project were:

1. Provided information on frequency propagation characteristics.

2. Provided additional trajectory information.

3. Served to add considerably to the cover plan.

C. Command Post Exercises: Commencing in late October 1955, Command Post Exercises involving the primary mission communications network were conducted almost continuously to provide maximum training for all personnel and test the adequacy of the system. Each exercise was approximately 5 days duration with a short break of 2 to 3 days to evaluate results. These exercises were planned to simulate balloon launching, tracking, fixing and recovery operations. Wherever possible command functions and procedures were employed to add realism. Applicable reports required by 1st Air Division Manual 55-8 were submitted and Air Weather Service support capability and other facets of the operation were exercised.

III. DEPLOYMENT PHASE:

A. The deployment schedule of launch and recovery unit personnel and equipment was finally predicated upon the designated date for commencement of operations and the requirement to attain operational proficiency prior to deployment. Also it was desired to have all operational units in place as far in advance of the

implementation date as possible to assure time for base "shake-down" and mission preparation. As previously stated, the target date for commencement of operations was advanced from 1 November to 1 December 1955. See Part 1, Chapter II.

1. 6926th Radio Squadron (Mobile): Deployment responsibility for tracking units was retained by USAFSS, since personnel were to be obtained from USAF-wide resources and USAFSS intention was to reassign such personnel and equipment within the Far East upon termination of the project. Deployment of personnel and equipment was commenced in June 1955 and was completed in August 1955. 725 personnel and 1,280,000 pounds of equipment were involved in this deployment.

2. 1110th Air Support Group: Deployment of the main body of the 1110th Air Support Group commenced on 10 October and was completed on 1 November 1955. A total of 743 personnel and 477,500 pounds of equipment were involved.

3. 456th Troop Carrier Wing: Deployment of the main body of the 456th Troop Carrier Wing commenced on 5 October and was completed on 20 November 1955. A total of 1,763 personnel, 2,751,290 pounds of cargo and 50 C-119 aircraft were involved.

B. There were 27,000,000 pounds of special equipment (Grand Union) shipped in support of this operation in addition to the previously mentioned equipment. This, plus other commitments, equaled an approximate overall total of 3,231 personnel and 32,000,000 pounds of cargo.

IV. PRE-OPERATIONAL DECISIONS:

A. Ground Cut-Down Stations: The original plan of operations called for high altitude operation (80,000 ft) of the 128TT balloon where winds were expected to be of moderate speeds posing a reasonable problem for intercepting C-119 aircraft. As a result, electronic balloon termination equipment was installed in project aircraft and no other means of termination was provided. The decision made during Moby Dick Hi to employ 66CT balloons (which fly at lower altitudes) in approximately equal numbers to the 128TT required a re-evaluation of termination and recovery plans. It was indicated that at the lower altitudes, wind speeds encountered would be such as to nearly double the expected rate of arrivals in the recovery area. Also, proximity to jet stream altitudes on arrival would result in rapid transit of the recovery area such that balloons might arrive during night and adverse weather, transit the area, and pass far beyond before aircraft could intercept them. It was known that under these conditions the balloon would travel at such speeds as to render

overtaking by C-119 aircraft impossible. It was immediately apparent that a requirement existed for a means to terminate balloons from the ground. From spare airborne electronic equipment available, ground cut-down stations were established at and at each of the recovery squadron bases except . To improve performance a specially constructed Yagi antenna was used. The range of these stations was such that unbroken ground cut-down coverage was provided from the northern tip of Formosa to the northern tip of Hokkaido, around Adak, and around Kodiak. During the operation, an additional station was established at The concept of employment of these ground cut-down stations contemplated that at night, during adverse weather, or in the absence of aircraft for the purpose, balloons would be terminated by the ground stations

It was thought, and later confirmed, that there would be little possibility of recovering gondolas from the open Pacific. In addition to requiring ground cut-down stations, the increased speed of the balloons required that the exposure rate of the duplex camera be changed from 12½ minutes to 6¼ minutes, to assure overlapping coverage.

B. Surface Recovery Support: With the expected increase in arrival rate and the installation of ground termination equipment, it was anticipated that many gondolas would fall on land with no opportunity for recovery by the C-119 aircraft, or in water where the aircraft recovery effectivity would depend upon state of the sea and proper functioning of the unproven water station. Based on these considerations a decision was made that supplementary recovery support was required. Through FEAF and AAC arrangements were made with CINCAL, CINCFE, and CINCPAC for recovery assistance from all United States forces operating within their theaters. News releases in the theaters solicited the cooperation of civilians by offering a reward for returned gondolas. Plans made were complete and detailed, and later proved to be most effective.

C. Preparations for Launch: In anticipation of starting the operation on 1 December 1955, action was taken to be prepared to launch from each site at the maximum rate, from the first day. These preparations included the generation and storage of hydrogen, and stockpiling of prepared systems in the mechanical and electrical configuration required.

D. Stipulations by Higher Headquarters:

1. Cover Plan Launches. USAF directed that cover plan balloon launchings be conducted in the Pacific area concurrently with the conduct of the primary mission. This operation was nicknamed White Cloud and was implementated by 1st Air Division Operations

Order 207-56; it provided for the launching of ten 124A type balloons each at , Hawaii, and Alaska during the period 9 January 1956 to July 1956. The first of these balloons was launched on 9 January 1956 with complete press coverage. This was one day prior to commencement of primary mission operations as had been requested by the State Department.

2. Placards: At the direction of USAF, a cartoon placard, multilanguage placard and Russian language placard were affixed to that part of the gondola housing the cameras. The placards indicated that a monetary reward would be given if the package were turned over to the proper authorities. Due to delayed delivery, the Russian language placard was affixed first on 23 January 1956, 13 days after the operation began.

3. Launch Limitations: For the first seven days of operation, launchings were restricted by Headquarters USAF to a total of ten effective balloons per each 24 hour period with an altitude ceiling restriction of 55,000 feet. (Note: An effective balloon is one which has been successfully launched, reaches planned altitude, and can be assumed to penetrate the area of interest.)

4. 2G-BO (Auxiliary Safety Unit): Safety measures against free fall of the equipment in the event of balloon failure during and after ascent were provided the 119L system by a safety chute and by the electronic package control unit. To give back-up protection against free fall, in addition to the above, USAF determined that an auxiliary safety unit, the 2G-BO, would be included in the system. Delivery of the 2G-BO to launch detachment was subsequent to termination of the primary mission, therefore it was never actively employed.

5. Locator Beacon: In May 1955 a requirement was stated for a locator beacon which, attached to the gondola, would send signals from a downed position to direct searchers to the location. Without such a beacon it was considered that downed gondolas would be difficult to find on land and practically impossible to find in water. For technical reasons, development was limited to a beacon which would work in water but not on land. It was designed with a salt water activated battery to transmit a UHF signal for 48 hours to a range of 100 - 150 nautical miles. Recovery aircraft and the Air Rescue aircraft were capable of homing on these signals using the AN/ARC-27 with the AN/ARA-25 homing adapter. Early attempts to test prototype and first production models of the beacon were inconclusive, and considerable delay was experienced in getting first article approval. However, because the beacons were known to be capable of functioning, 501 were accepted and shipped to launch sites for use prior to receipt of first article approval. This approval was received on 4 January 1956. A beacon was to be attached to each system launched.

E. Planned Configuration: The configuration of balloon-gondola assemblies planned for the beginning of operation was in consonance with other operational decisions and was standardized for all launches regardless of balloon type. Principal features were:

1. Basic configuration was normal, consisting of balloon, load straps, rotator, bar assembly, parachute cluster, water station, DMQ-1, thermal package for electronic gear, and two ballast boxes.

2. A 24 foot emergency parachute was rigged between the gondola and the balloon to prevent free fall of any portion of the vehicle in the event of balloon failure during ascent.

3. Four packages of chaff were attached to the bar assembly and rigged in such a manner as to be automatically dispersed on bar separation. The purpose was to provide positive fixing of termination position by radar.

4. A radiosonde unit was attached to the system to provide information on level-off altitude if the ascent were successful, or to give a positive indication if failure occurred within approximately two hours of launch.

F. Tactics: Because of the relatively inflexible nature of the the balloon system and the fact that maximum altitude had been prescribed, few tactical decisions were necessary. Those found necessary are described briefly below:

1. Based on meteorology, radio transmitter turn on times were established to insure that regardless of wind speed encountered (within reasonable limits) the transmission would begin prior to arrival of the balloon in the recovery area.

2. Camera turn on times were to be delayed long enough in each case to avoid the possibility of photographing friendly territory.

3. The 66CT balloons were to be launched from the two German sites so as to penetrate the border during hours of darkness. The 128TT was not restricted as to hours of darkness, nor was the 66CT when launched from the other three sites.

4. To obtain sufficient balloon life expectancy (7-8 days) and stay within the prescribed altitude ceiling, the 66CT balloons were prepared for a planned initial altitude of approximately 46,500 feet and a ballasting altitude of 40,000 feet; 128TT balloons were prepared for an initial altitude of 50,000 feet and a ballasting altitude of 45,000 feet.

V. OPERATIONAL PHASE, PRIMARY MISSION:

A. General: By 1 December 1955, the established date for commencement of operation, all units were in place and operationally ready. Pending receipt of an execution order command post exercises, Moby Dick Far East, and other training in mission accomplishment continued. Also advantage was taken of this period to continue the distribution of additional production material to the overseas locations.

1. The mission was ordered executed on 10 January 1956. Eight effective balloons were launched on that date.

B. Launching:

1. Subsequently, balloons were launched daily at rates consistent with the directed limitations except as further limited by political considerations and surface weather. Launch teams of the 1110th Air Support Group turned in exceptional performances, demonstrating on some occasions capability to exceed the maximum launch rate programmed.

2. The limitation to 10 effective launches per day continued in effect until 17 January when it was increased to 20 per day. On 25 January it was increased to 30 per day; and to 40 per day on 28 January.

3. Although experiencing their worst winter weather for several years at the launch sites, pre-mission predictions of percentage of weather favorable for launch were found to be quite accurate. As expected, from standpoint of surface weather, was the poorest site and the best. The original concept in regard to weather was that balloons could not be launched in the presence of any precipitation, fog, or icing. Because such restriction would have an adverse effect on capability to meet daily quotas, it was decided to test feasibility of launching under these conditions. From these tests it was concluded that balloons can be successfully launched during periods of fog and light precipitation in the absence of severe icing conditions. Weather criteria for launch were changed accordingly.

4.

C. Tracking: Tracking detachments obtained 22,867 bearings which were used in plotting balloon positions during the operation. This does not include the many single bearings which were obtained on transmissions from balloons which were heard at least one time, since such bearings could not be used for position fixing. Often only an initial transmission would be received, after which the balloon was not heard from again; further, some of the initial transmissions were termination signals which indicated loss, either by a system failure or unfriendly countermeasures. A deficiency was noted in the tracking capability over the Bering Sea and Northwestern Alaskan area. To offset the deficiency, a detachment was formed from in-place resources and located at Nome. The detachment became operational after termination of the operations; as a result, it did not contribute to the mission.

D. Recovery: Recovery activity functioned smoothly and effectively. With few known exceptions balloons were tracked prior to arrival and were terminated. As expected, arrivals occurred at night and during adverse as well as good weather. The average speed of travel in the recovery area was close to 100K. The requirement for ground cut-down stations was fully justified under these conditions because it was necessary to terminate 14 balloon flights by this method. Thirty seven were terminated by aircraft, several expired normally in the recovery area, and one was terminated by a friendly fighter. Due to weather and other operational considerations, the C-119 aircraft had an opportunity to recover only 19 gondolas from the air and were successful in 16 attempts.

1. Surface recovery support in the FEAF area was a source of great satisfaction. The 3d Air Rescue Group did a fine job in both locating and recovering downed packages. To date a total of 28 packages have been recovered through all agencies participating in the surface recovery support plan.

2. Procedures established for the return of recovered gondolas to the ZI via MATS after collection and processing by FEAF were very effective. The average time required for delivery to the 15th Reconnaissance Technical Squadron at March Air Force Base was 75 hours.

E. Major Problems:

1. The UHF locator beacon failed to operate on the first few systems which terminated in the sea in the recovery area. This led to a series of tests, both by the manufacturer on recovered beacons, and at launch sites by launch personnel to determine cause factors. Those returned to the manufacturer from the recovery area were found to work unless too badly damaged. Aside from occasional equipment breakage in launch, no reason for beacon failure could be determined, and it was concluded that the fault was in the floating attitude of the gondola to which it was attached. Unless it floated so that the battery was under water, the battery would not be activated. Action was taken to correct the floating position to insure best chances for beacon operation.

2. The water station, although it had never been fully tested and proven, was rigged for operation on all of the initial flights; however, since the locator beacon did not function on the first few gondolas which went down in the water, these gondolas were not located by project aircraft and there was no opportunity to use the water station. On those which were picked up by boat there was no indication that the water station had erected. Soon after

commencement of operations, a friendly national was injured while tampering with the water station activation squib found on the gondola of a balloon which had failed in the launch area. Subsequently, the squib was removed as a hazard, and this rendered the water station incapable of operation. However, it was necessary to continue attaching it to the gondola because it's weight was needed to cause the gondola to float with the beacon battery under water. Development of a means to insure proper floating attitude without this piece of equipment was initiated immediately since it was thought that complete removal of the water station would reduce radar sighting capability. At time of suspension of operations a suitable method had been devised and tested, but it was never used.

3. An analysis of balloon profiles taken from data recorded by recovered gondolas disclosed two significant factors. First, balloons were not approximating their estimated life expectancy. Instead of expending ballast equal to 7% of gross load per day, the average expenditure was about 10%, reducing life expectancy from 7-8 days to 4-5. It appeared that atmospheric disturbances caused variations in floating altitude that resulted in two, and sometimes three, ballasting periods during 24 hours rather than the one ballasting period expected. The necessarily narrow spread (5-6000 ft) between initial altitude and ballasting altitude is thought to be contributory to this phenomenon. Secondly, it was found that balloons spent considerably more time at the ballasting altitude than was anticipated. It was thought that with sunrise the balloon would make a fairly rapid ascent to its maximum altitude, and that it would remain there until late afternoon when it would descend because of cooling. Thus, for most of the day it would be high enough to reduce vulnerability to a minimum. Periods of greatest vulnerability would be early morning and late afternoon. This was found not to be the case. Although it rose rapidly in early morning, it began to cool and descend very shortly after noon; arriving at ballasting altitude with several hours of daylight left; and of course was most vulnerable during that time. Undoubtedly, there is a close relationship between this phenomenon and the one previously discussed in regard to over-ballasting. Both factors significantly reduced the chances of any balloon to successfully make the trip to the recovery area, either because of reduced normal life or increased vulnerability. Both were, however, operationally inescapable within the range of altitude to which flight was limited by directive.

4. As previously stated, at the start of operations 1st Air Division had approximately 1300 128TT balloons and 1500 of the 66CT type. To get an early indication of which type would be most effective operationally, both types were launched in approximately equal numbers at the beginning of operations. Moby Dick Hi results had indicated

that the 128TT ascent success rate to be expected would vary from about 80% success with higher serial numbers, to 50% with lower serial numbers; the break point being at or near serial number 1000. In order to pin down within the number of 128TT balloons available a point below which the failure rate would be excessive, it was decided to launch in serial number blocks of 100, starting from the highest numbered balloons and launching in numerical progression downward at each site, except that a test quantity of low serial numbered balloons would be launched to determine if failure rate confirmed the Moby Dick Hi findings. After several days of operation, the ascent success rate of the lower serial numbers was found to be 47% as compared to 83% for the higher serial numbers. A decision was then made that all 128TT balloons with serial numbers lower than 950 would be set aside and not used. This resulted in a reduction of the useable balloon inventory by approximately 700 balloons and left a deficit of 500 which would be required if the mission objective of launching 2500 was to be achieved. To eliminate this deficit, a requirement was stated for delivery by 1 March of balloons of a new type which would combine the strength of the 66CT and approach the altitude capabilities of the 128TT, at the same time providing more operational flexibility. Such a balloon was designed (the 83CT) and a few were test flown by AFCRC. Procurement was on schedule for delivery in March 1956, but was halted when operations were suspended and none were ever delivered.

5. Since the decision to set aside the low numbered 128TT balloons left only a limited number in the inventory, it was decided to conserve these for a later period when their use might be mandatory to avoid attrition by flying at higher altitudes. (The 66CT was not capable of use at higher altitudes without drastic reduction in life expectancy). Accordingly, only 66CT balloons were launched beginning 22 January 1956.

6. By 3 February 1956 it became apparent that attrition was unacceptably high at the lower altitudes and 128TT launchings were resumed using slightly higher altitudes than previously (54,000 ft initial floating altitudes; 50,000 ft ballasting altitude). This was maximum possible altitude under the existing directives, and Headquarters USAF was asked to raise the ceiling to a minimum of 60,000 ft, or to eliminate it entirely.

F. Suspension of Operation: On 6 February stand-down of all launches was directed.

1. An appraisal of the situation at this time indicated that one of two courses of action should be followed in the event resumption of operations was authorized.—One was to launch all

usable balloons (including the supplementary 83CT's) at maximum rate possible and at maximum altitude. The objective would be to saturate or avoid defenses and end the mission on the earliest date possible. Capability to complete entire mission by mid-April existed if operations were resumed prior to 15 February. The alternative was to continue only with the remaining 400 high serial number 128TT balloons which could possibly be flown above defenses. To increase the difficulty of detection, water stations would be removed and the maximum altitude would be flown. Through these measures it was thought that the operation might attract less attention and thus be acceptable. These proposals were made to Headquarters USAF on 9 February 1956.

2. Headquarters USAF favored the alternate proposal (launch only the 400 128TT balloons) if operations were to be resumed, but removed altitude restrictions entirely for only 10% of the number. The remaining 90% were limited to a maximum of 58,000 ft. On 24 February, Headquarters USAF advised that a proposal for resumption of operations under these ground rules at the earliest possible date had been sent to the Secretary of the Air Force.

G. Termination of Operational Phase:

1. Informally on 29 February and by message on 1 March 1956, USAF directed termination of the operational phase of the project, except that search for and recovery of unaccounted for gondolas would continue.

2. By Headquarters USAF directive, 1st Air Division and Strategic Air Command relinquished operational control of operational units to parent commanders on 26 March 1956. (Redeployment of these units and disposition of surplus materiel became a responsibility of the parent commands and Air Materiel Command.)

VI RESULTS:

A. During the operational period, 516 balloon systems were launched. Of these systems 399 were considered to be operational; there were 117 known failures, and 12 of those considered operational were later recovered from friendly areas without having entered the target area. Of the remaining 387 operational balloons, 144 were later heard to transmit, of which 123 were tracked, and 21 were termination signals heard as the first transmission; 243 were never heard from after launch. Of the 123 which were tracked, only 67 entered the recovery area. 57 of these were terminated and 44 of them had been returned as of 5 March 1956. Of the 13 which were terminated but not recovered, 4 have terminal positions on land, 9 in the sea (7 Pacific, 2 in Sea of Japan). The 10 which arrived but were not terminated are presumed to be down in the Pacific or in the Polar regions. Although termination was attempted on 6 of these, all attempts were unsuccessful, presumably because of failure of balloon electronic gear to

respond. Four entered the recovery area only by definition, since they were too far to the north for interception.

B. Fifty-eight balloons heard to transmit, were tracked, but never arrived. These were functioning systems and from all indications most of them should have been blown into the recovery area. However, the vast majority of them ceased their transmission prior to their seventh day of life. One cluster of eighteen balloons was being tracked across the North China area heading directly for Japan, - only three actually arrived and nothing more was heard from the remainder. There are several possible causes. Electronic malfunction could have resulted in cessation of transmissions; over-ballasting, as previously discussed, could have resulted in premature flight termination behind the lines; they could have been terminated by enemy action; or their trajectories may have been such as to carry them beyond listening range.

C. Two hundred forty three balloons were never heard from after launch. This means that they were either travelling in the wrong direction completely; they experienced complete failure of the HF transmitter; or they failed to live until their programmed turn-on time. Since many of these balloons were launched close in time to balloons which later arrived, trajectory is thought to be responsible for only a small percentage. From Moby Dick Hi statistics it was reasonable to assume that 85% of the transmitters would function properly. This leaves the vast majority in the category of not having lived long enough to transmit. It is reasonable to assume that some launches which were considered successes, in actuality were not. Perhaps the launch personnel were unable to monitor the flight long enough to observe failure; perhaps minute holes were in the balloon allowing the gas to leak out over a period of hours; perhaps the ballasting mechanism failed and caused the balloon to descend to the ground. Although over-ballasting is known to have shortened balloon life to a degree, this degree was not such that a large number would expire for this reason prior to turn-on time. Although no exact values can be placed on any of the above factors; even in combination, it is considered unreasonable that they could have been responsible for early termination of such a large number of balloons. It is concluded, then, that the major contributing factor to loss of these balloons was attrition by enemy action. This conclusion is strengthened by the fact that, enjoying the element of surprise, balloons launched prior to 26 January were fairly successful; however, of 184 balloons successfully launched on and after 26 January only 28 were heard to transmit and only two were recovered. This indicates that after two weeks in which to react, the USSR had come up with an exceptionally effective defense. Contrary to the radar tracking capability demonstrated in the ZI during Moby Dick Hi, 12th Air Force radars were able to track balloons

up to 150 miles across the line; it is assumed, therefore, that Russian radars were similarly capable. The length of the metal cross-bars and the metal water station increased radar vulnerability. It was known beforehand that Russian fighters were capable of attaining the altitudes to which the balloon flights were restricted (55,000 ft). Vulnerability was certainly affected by balloon behavior, as previously discussed, in descending to ballasting altitude (40,000 to 45,000 ft) shortly after noon.

1. As the effect of attrition became noticeable, such steps as were possible were taken to minimize the vulnerability. Altitude was increased to the limit possible within the directed ceiling and radio turn-on times were delayed to deny use of these signals as an aid to the enemy. Plans were made to remove the water station entirely, in order to minimize radar detection; removal or raising of altitude restrictions was recommended to USAF; balloon transmitters were not to be turned on until the very last day of programmed life. Operations were suspended before all of these measures could be placed into effect.

D. All systems launched carried the DMQ-1 (photographic) gondola. No DMQ-2 (electronic ferret) packages were launched since this type of equipment was not perfected in time.

E. A summary of photographic accomplishments processed by the Aeronautical Chart and Information Service as of 30 March 1956, is as follows:

1. Total number of missions from which photography was obtained - 40.

2. Total number of usable exposures - 13,813.

3. Gross statute miles of charting photography - 1,984,173.

4. Net statute miles of charting photography - 1,661,869. (equal to approximately 51% of the Continental United States)

5. Gross square statute miles of charting photography for Sino-Soviet area - 1,388,745.

6. Net square statute miles of charting photography for Sino-Soviet area - 1,116,449 - (equal to 37% of the Continental United States, or approximately 8% of Sino-Soviet area).

7. Cost per square mile (net) $48.49.

TAB A

CONCLUSIONS

I. CONCLUSIONS: It is concluded that:

A. Weapons System 119L was a reasonably effective means of obtaining pioneer reconnaissance at comparatively small cost.

B. The predicted upper air trajectories over the USSR and its satellites was as accurate as could be expected.

C. The delay in commencing the operation (from 1 December 1955 to 10 January 1956) compressed the project, time-wise, to within a very short period of favorable winds. However, the operation could have been completed (2500 launches) by 1 May 1956, if project had been permitted to continue.

D. The element of surprise contributed appreciably to the successful results obtained during the initial days of the operation.

E. Vulnerability to unfriendly countermeasures and over-ballasting were the two factors contributing most to failure to transit the target area.

F. Ground termination stations are a mandatory back-up for other recovery techniques.

G. Deficient polyethelyne and manufacturing defects caused a deficit of approximately 700 balloons in the operational inventory.

H. The type of photography obtained affords an excellent source for pioneer reconnaissance, but due to limiting factors, detailed analysis of new intelligence is difficult. (See Tab "J", Chapter III)

I. The findings of the Moby Dick Hi vulnerability tests, involving the Air Defense Command, were misleading, Since 12th Air Force radars (MSQ-2) were capable of tracking balloons at high altitude and at ranges up to 150 nautical miles, it is concluded that Soviet radars have similar capability; therefore, in design of any future system for this purpose, care should be taken to minimize radar reflective surfaces and materials.

J. More specific knowledge of balloon performance must be obtained, and design influenced thereby, in order to obtain everything possible from this weapons system.

K. The C-119 aircraft:

1. Is useful to perform air-to-air electronic cut-down, however, this could be accomplished by several other aircraft types.

2. Is too slow to overtake the balloon due to approximately equal groundspeeds of the balloon and aircraft under certain jet stream conditions. Success was assured only when the aircraft could assume a position ahead of the balloon.

3. Air-to-air recovery capability was dependent upon the existence of daylight and VFR conditions.

L. Surface recovery of all packages should be planned as the primary method of recovery with a suitable and fool-proof method of locating the package, such as a beacon capable of operating on land and water.

M. Due to excessive ballast rates, duration was marginal. The reconstructed profiles indicate that the life expectancy is somewhat shorter than the theoretical average of 7 and 8 days for the 66CT and 128TT respectively. See Tab "N", Chapter III.